A

PROJECT REPORT

ON

"Timer Based Motor ON / OFF Control"

Submitted To The

Maharashtra State Board of Technical Education, Mumbai

For the Degree of

Diploma of Engineering

In

Electrical Engineering

Under the Faculty of Diploma Engineering

By

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Under Guidance of

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Zirapwadi , Tal-Phaltan , Dist- Satara, Pin: 415523.

Year 2020-2021

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Jay Bhavani Education Society

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CERTIFICATE

This is to certify that Project report entitled "Timer Based Motor ON / OFF Control" is submitted by Nale Ganesh Shrirang and Seat No - 209562 in the partial fulfillment for the award of Diploma in Electrical Engineering by Maharashtra State Board of Technical Education, Mumbai . The Project Work is done under my supervision in the academic year 2020-2021.

Seat No : 1915700071

Date : 20/05/2021

Internal Examiner | External Examiner | HOD 20/05/2021 | Principal

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ACKNOWLEDGEMENT

This project is one of the milestones in my career. I take this as the humble opportunity to express my deep sense of gratitude to Prof Mrs. Chopade H.A. of guide for his knowledgeable guidance.

I am thankful to Prof. A.U. Mohite, Principal & Prof. , H.O.D. of mechanical Engineering Department R.G.P. Phaltan, for giving me an opportunity to present this Project& his helpful guidance.

I will be failing in my duty, if I do not express my gratitude towards staff members & friends who helped to me to complete my project work successfully & in time.

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Abstract

This project is to Control the Motor Operation by using Timer. Now a day's most of the industrial sectors are automated. In that industries the machines and the models are used for work done are mostly independent of the human operation. So for that we have to build a system on the basis of need of the industry.

This project is the basic scenario that gives complete idea about the ON/OFF methodology of motors which can be done at low cost level. This circuit is very useful where the repeated process is followed for the some special operations like bottle filling, door ON/OFF, and etc. where we can use the repeated operations.

Furthermore, this project can be enhanced by using high performance and high rating equipment's and this can be used for large operations also.

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CHAPTER 1

INTRODUCTION

Now a day's most of the industrial sectors are automated. In that industries the machines and the models are used for work done are mostly independent of the human operation. So for that we have to build a system on the basis of need of the industry. The research says that when goes thought the industrial automation phase we must look for the cost saving and good quality of work for that industry. Also the automation which we are doing in that industry are must be pollution free and also make very less damage for the inbuilt environmental conditions. Going through the same way of understanding one of the most important factor is cost of the automation which we are building by removing old manmade manual system.

In this project scenario we are building the system which will definitely help the industrial automation work but also achieve one of the most satisfactory part of the automation which is cost saving. Most of the industries choose the repeated time work scenario that means the work done with some drives or motors in repeated manner. So for that we should very know about what type of system we are installing to fulfill which type of work strategies? The answer of that question is we have to make force on audit/survey for the automation purpose.

This project is the basic scenario that gives complete idea about the ON/OFF methodology of motors which can be done at low cost level. This circuit is very useful where the repeated process is followed for the some special operations like bottle filling, door ON/OFF, and etc. where we can use the repeated operations. This circuit contains a signal giving device called push button which gives triggering signal to the timer IC to generate the clock pulse. One variable resistor is given in the circuit to vary the length of the clock pulse. By adjusting the resistance of the variable resistance we can adjust the clock pulse and by adjusting the clock pulse we can manage the ON/OFF timing if that motor. For trip circuit one relay is used which provides contacting and discontenting operation for the motor.

If in case in running condition the mains supply gets off due to Electricity utility problem, our mains switch or MCB is not get off automatically. Then after mains supply

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is get back to on position due to main switch / MCB is already in ON condition, our motor or any machine can gets damage due to over voltage or over current. So for the protection of the machines we can use the circuit.

Now second application of this circuit is that the timing ON / OFF operation. In that if we have to some operation by giving a fix timing for ON/OFF then this also possible by using this circuit. These are the two applications we are designated in this circuit to get better performance for industrial machines.

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CHAPTER 2

LITERATURE REVIEW

2.1 Visits in Small Scale Industries:

We visited to the small scale industries in our area. In those industries we observe the switching methodology used for the machinery that is working on the repeated theme of operation. From that we decide to do some cost effective equipment for the repeated theme of operations by which we can give the solution of switching maintenance and switching equipment costing.

2.2 Designing in the way to reduce the Cost:

Our main objective is to reduce the cost of switching and to give the protective equipment for that machinery. So for that we did a survey to find out the equipment's that we can use for the auto switching and also we can get that in the minimum cost. So from that survey we designed the circuit for that and we complete our work.

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CHAPTER 3

SIGNIFICANCE OF TOPIC

3.1 Significance of Topic:

1. Easy start and stop operation of motor.
2. Protect machine by direct ON after switching
3. For repeated and fixed timing operation it can easy to make switching.
4. It can reduce the fault occurring frequency due to overvoltage.

3.2 Constraints or Difficulties Faced:

1. Calculation of Tank circuit for timing operation.
2. Calculation of resistance.

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CHAPTER 4

PRINCIPLE OF OPERATION

This project is to operate motor with safe ON / OFF operation. For that we are using 6V supply for the circuit operation. The 230V/12V step down transformer is used to step down the voltage. This voltage is given to the diode bridge which works as a rectifier. This rectified output of the diode is given the voltage regulator (IC 7806). This gives the regulated output. Then this regulated output is then given to the capacitor which is used as a filter. Filter removes the AC component in the pulsating DC. Now our circuit working is started.

The tank circuit of variable resistor and capacitor is used to set timing signal. This circuit gives the timing in the form of charging signal to the IC 555. We can adjust the timing by varying the knob of variable resister. When we start mains supply the buzzer is on and it gives signal that supply is on. Then at that time our motor is remains in off state. This is because for the motor protection. As we not press our push button the transistor. Q1 is in off state where Q2 and Q3 are in ON state. These transistor switching completed the path of the buzzer circuit. When we press the push button the triggering is given to the timer. The output of the transistor remains present till the capacitor remains charged. The timer output is given to the transistor Q1. Transistor Q1 start and it complete the path of relay coil charging. Then relay trips and motor is gets ON. Then after discharging of capacitor the timer's output is OFF and transistor Q1 stops the relay and motor get OFF. Then Q2 and Q3 complete the buzzer circuit path and buzzer ON.

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CHAPTER 5

PROJECT DEVELOPMENT STAGES

STAGE 1-

Formation of group and guide allocation.

STAGE2-

Searching of project topic and related information.

STAGE3-

Submitting the area of interest subject.

STAGE4-

Decide name of the topic on basis real time.

STAGE5-

Start collection of information and IEEE paper related to project

STAGE6-

Present actual concept of this project to guide.

STAGE7-

Start work on project under giddiness of Mrs. Chopade Madam

STAGE8-

Selection of equipment work on the innovation.

STAGE9-

Initial approximate cost of project.

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STAGE10-

Purchasing equipment from market.

STAGE11-

Starting assembling of equipment.

STAGE12-

Computing the actual results.

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CHAPTER 6
BLOCK DIAGRAM DESCRIPTION

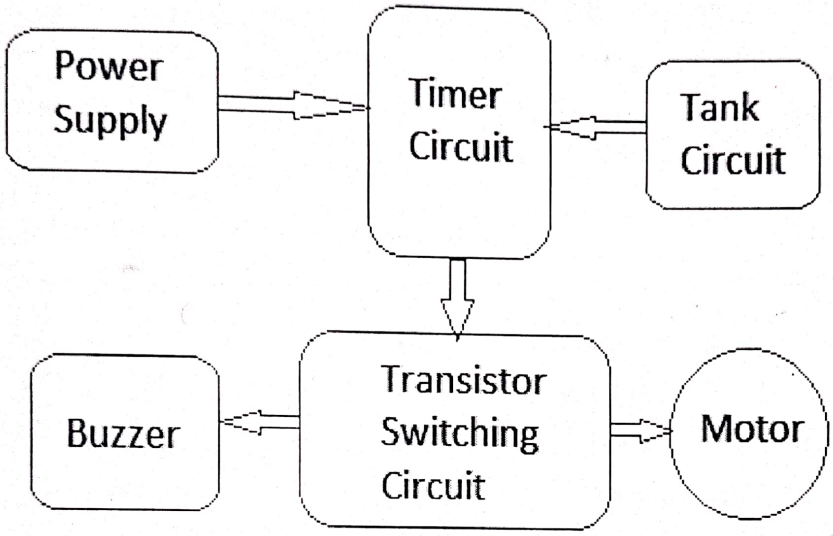

Fig.6.1 Block diagram

Description:

The fig.1 shows the block diagram of "Timer Based Motor ON / OFF Operation". The block diagram contains a DC power supply which feds power to the whole circuit. The timer circuit which is used for timing operation. The Tank circuit which is used to give the charging supply for the timer for its timing operation. The transistor switching circuit is used for switching between the Buzzer and Motor.

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CHAPTER 7

Circuit Diagram

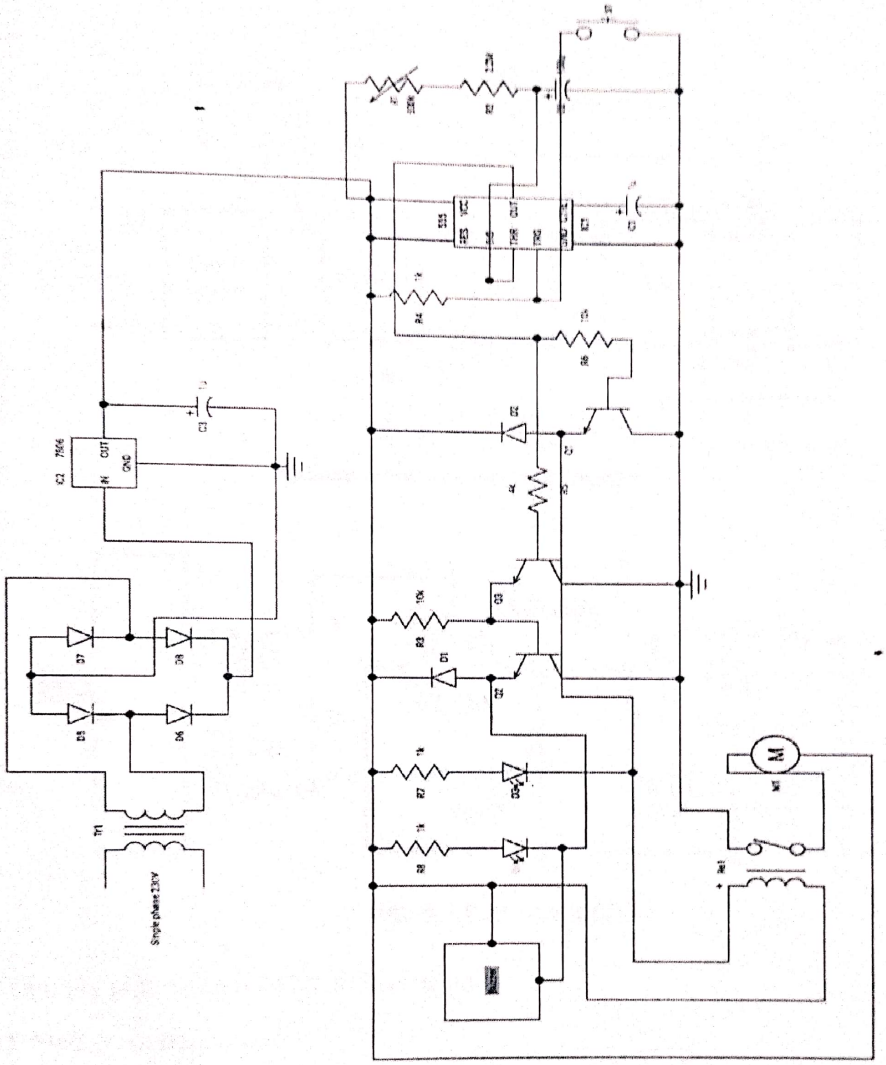

Fig. 7.1 Circuit Diagram

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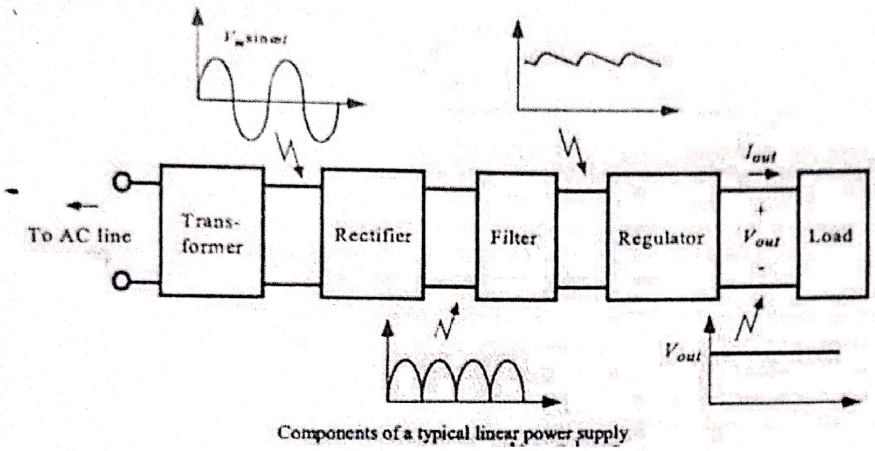
CHAPTER 8
HARDWARE DESIGN CIRCUITRY

8.1 Power supply:



Components of a typical linear power supply

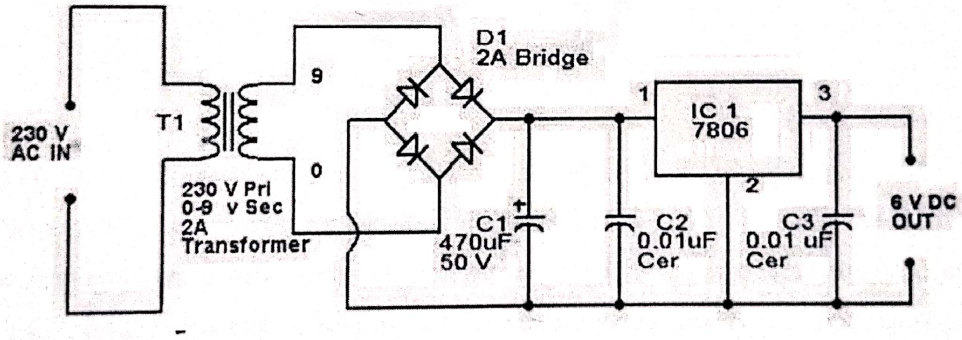


Fig. 8.1 Power Supply

Power supply unit consists of the following units:

a) Step down transformer

b) Rectifier unit

c) Input filter

d) Regulator unit

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a). STEP DOWN TRANSFORMER:

The instrument transformer for power supply in this project is to convert AC from 230V to required low level such as 6V AC. This transformer apart from stepping down AC voltage gives isolation between power source and power supply circuitries. This is core type two winding transformer.

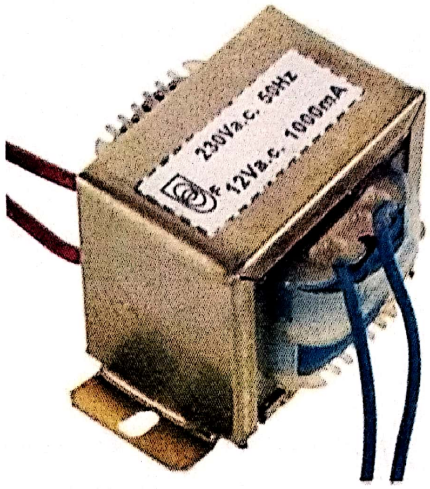

Fig. 8.2 Transformer

b) RECTIFIER UNIT:

In a power supply unit, rectification is normally achieved by a solid state diode. This project employs a full wave bridge rectifier which is most commonly used in industries. A bridge structure of four diodes is commonly used in power supply units to achieve full wave rectification. When AC voltage is applied to the primary winding of power transformer. It is stepped down to 6V AC across the secondary winding of the transformer. The output of rectifier is pulsating DC.

Fig. 8.3 Diode Bridge

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8.2 Timer (IC 555):

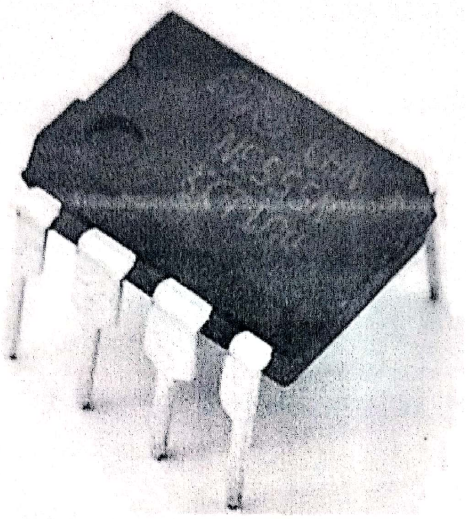

Fig. 8.6 IC 555

The **555 timer IC** is an integrated circuit (chip) used in a variety of timer, delay, pulse generation, and oscillator applications. Derivatives provide two or four timing circuits in one package. It was commercialized in 1972 by Signets. Numerous companies have made the original bipolar timers and similar low-power CMOS timers too. In 2017, it was said over a billion 555 timers are produced annually by some estimates, and probably the most popular integrated circuit ever made.

8.2.1 Internal schematic:

The internal block diagram and schematic of the 555 timer are highlighted with the same color across all three drawings to clarify how the chip is implemented.

a) Green: Between the positive supply voltage V_{CC} and the ground GND is a voltage divider consisting of three identical resistors, which create two reference voltages at $\frac{1}{3}$ V_{CC} and $\frac{2}{3}$ V_{CC}. The latter is connected to the "Control" pin. All three resistors have the same resistance, 5 kΩ for bipolar timers, 100 kΩ (or higher) for CMOS timers.

b) Yellow: The comparator negative input is connected to the higher-reference voltage divider of $\frac{2}{3}$ V_{CC} (and "Control" pin), and comparator positive input is connected to the "Threshold" pin.

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c) Red: The comparator positive input is connected to the lower reference voltage divider of ⅓ V_{cc}, and comparator negative input is connected to the "Trigger" pin.

d) Purple: An SR flip-flop stores the state of the timer and is controlled by the two comparators. The "Reset" pin overrides the other two inputs, thus the flip-flop (and therefore the entire timer) can be reset at any time.

e) Pink: The output of the flip-flop is followed by an output stage with push-pull (P.P.) output drivers that can load the "Output" pin with up to 200 mA for bipolar timers, lower for CMOS timers.

f) Cyan: Also, the output of the flip-flop turns on a transistor that connects the "Discharge" pin to the ground.

555 IC Timer Block Diagram

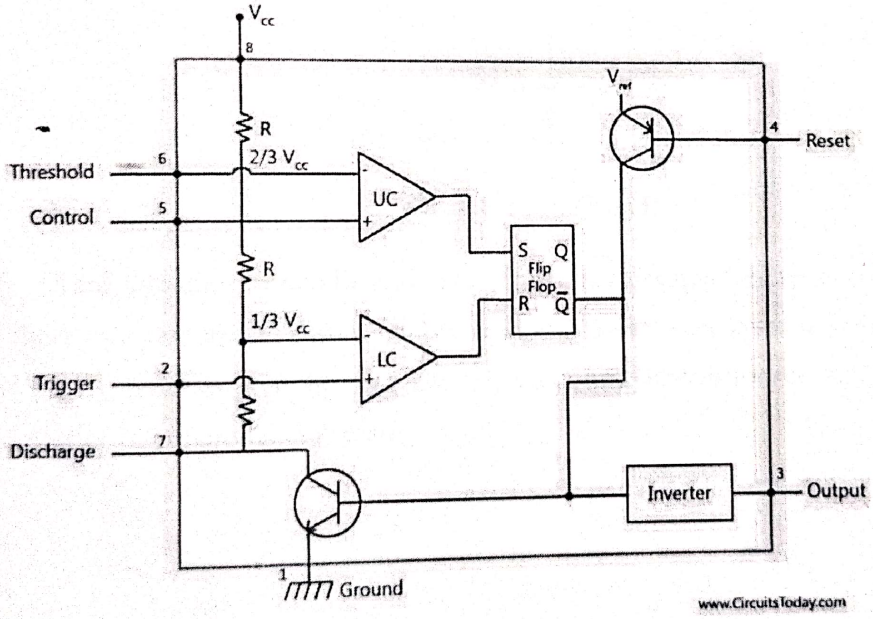

Fig. 8.7 IC 555 (Internal Diagram)

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8.3 Tank Circuit:

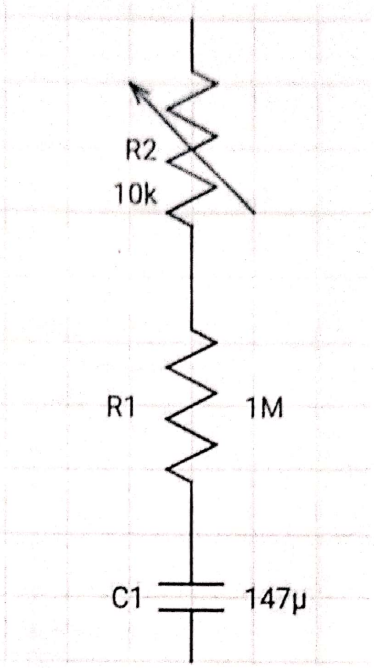

Fig. 8.8 Tank Circuit

Tank circuit is the combination of resistor and capacitor used to set the timing for the timer by charging the capacitor. The charging of capacitor gives the exact working time for the timer to give the output to the transistor. Here resistance of 1M ohm and capacitor of 147 micro farad is used.

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8.4Transistor Switching Circuit:

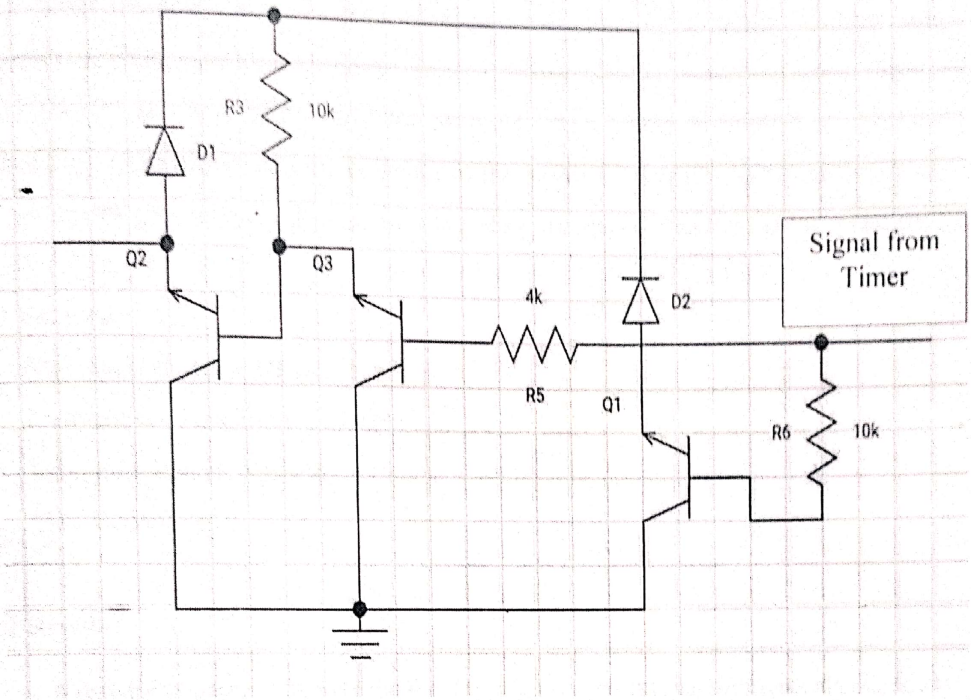

Fig. 8.9 Transistor Switching Circuit.

The transistor switching circuit is having three transistors which are used for the switching purpose. These transistors are allowed for the motor and buzzer operation. The transistor Q1 is BEL 187 and Transistor Q2 & Q3 are BC 547. The signal given by transistor Q1 is used to switch ON the motor and Signal given by the transistor Q2 & Q3 are used to operate the Buzzer.

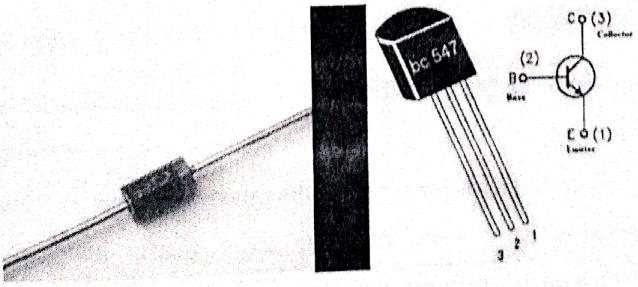

Fig. 8.10 Diode and Transistor.

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A transistor is basically an electrically controlled switch. There is an input, output, and a control line referred to as the emitter, collector, and base. When the control line (base) is triggered it will connect the emitter and the collector just like switching a switch. Since the power between the emitter and collector can be higher than the base, transistors are often used as amplifiers.

The BC 547 is a NPN transistor meaning when power is applied to the base (control pin) it will flow from the collector to the emitter. Typically NPN transistors are used to "switch ground" on a device, meaning, they are placed after the load in a circuit.

8.4.1 Features:

- Maximum Current: 100mA
- Frequency – Transition: 300MHz
- Maximum Power: 500mW
- Max Voltage: 45V

8.4.2 Resistor:

A resistor is passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits. The electrical function of a resistor is specified by its resistance; common commercial resistors are manufactured over a range of more than

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nine orders of magnitude. The nominal value of the resistance falls within the manufacturing tolerance, indicated on the component.

The notation to state a resistor's value in a circuit diagram varies. One common scheme is the RKM code following IEC 60062. It avoids using a decimal separator and replaces the decimal separator with a letter loosely associated with SI prefixes corresponding with the part's resistance. For example, *8K2* as part marking code, in a circuit diagram or in a bill of materials (BOM) indicates a resistor value of 8.2 kΩ. Additional zeros imply a tighter tolerance, for example *15M0* for three significant digits. When the value can be expressed without the need for a prefix (that is, multiplication 1), an "R" is used instead of the decimal separator. For example, *1R2* indicates 1.2 Ω, and *18R* indicates 18 Ω

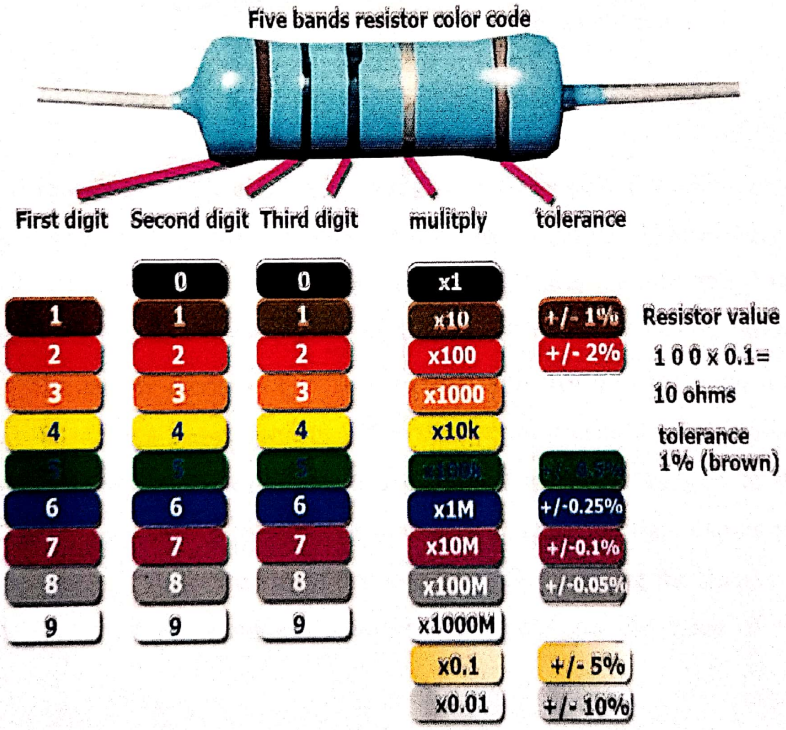

Fig. 8.10 Resistor Color Code

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8.5 Buzzer

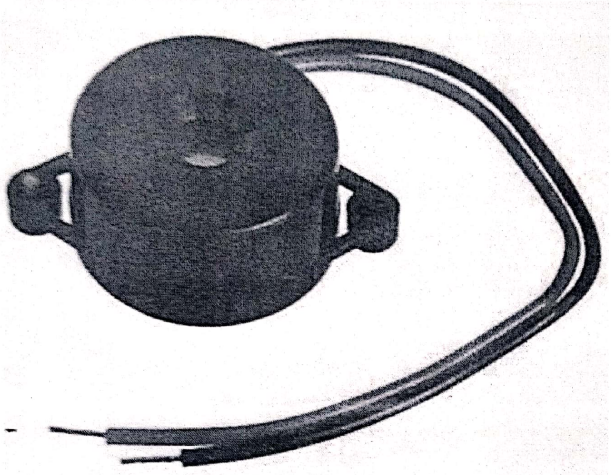

Fig. 8.11 Buzzer

The fig. shows an electric buzzer which is used to give alert. This is an electromechanical buzzer having two terminals positive and negative. This is buzzer work on DC supply. Buzzers can be both fun and useful in electric circuits. We'll use them a lot in Make Crate projects, so let's take a look at what is going on inside a buzzer to produce sound. The buzzer consists of an outside case with two pins to attach it to power and ground. Inside is a piezo element, which consists of a central ceramic disc, surrounded by a metal (often bronze) vibration disc? When current is applied to the buzzer it causes the ceramic disk to contract or expand. Changing the then causes the surrounding disc to vibrate. That's the sound that you hear. By changing the frequency of the buzzer, the speed of the vibrations changes, which changes the pitch of the resulting sound.

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8.6 Motor

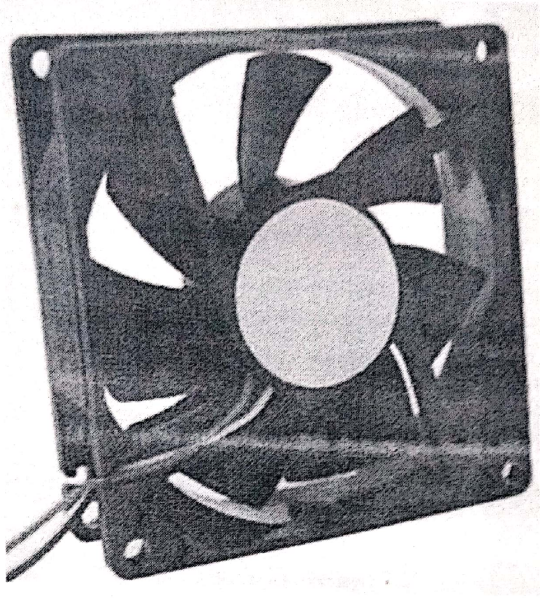

Fig. 8.12 Motor

The fig. shows the DC motor with a small fan. This short motor is used for demonstration purpose instead of a large size motor. This is permanent magnate DC motor with a Fan.

8.7 Relay:

Relays are most commonly used switching device in electronics. There are two important parameters of relay, first is the Trigger Voltage, this is the voltage required to turn on the relay that is to change the contact from Common → NC to Common → NO. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range.

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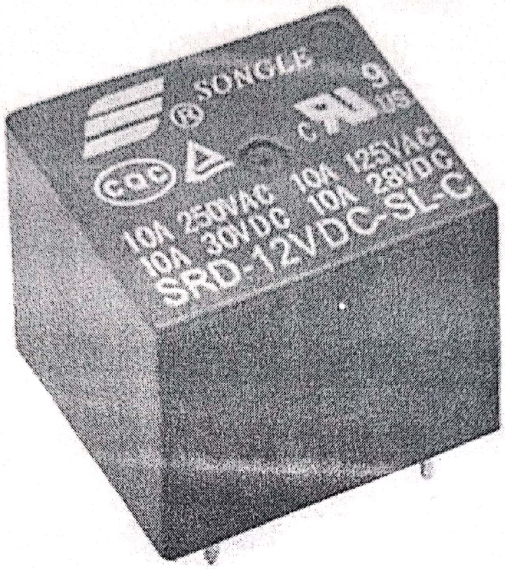

Fig. 8.13 Relay

The above diagram is for relay triggering circuit. Since the relay has 12V trigger voltage we have used a +12V DC supply to one end of the coil and the other end to ground through a switch. For switching we are using a transistor as a switching device. You can also notice a diode connected across the coil of the relay, this diode is called the Fly back Diode. The purpose of the diode is to protect the switch from high voltage spike that can produced by the relay coil. As shown one end of the load can be connected to the Common pin and the other end is either connected to NO or NC. If connected to NO the load remains disconnected before trigger and if connected to NC the load remains connected before trigger.

Applications:

- Commonly used in switching circuits.
- For Home Automation projects to switch AC loads
- To Control (On/Off) Heavy loads at a pre-determined time/condition
- Used in safety circuits to disconnect the load from supply in event of failure
- Used in Automobiles electronics for controlling indicators glass motors etc.

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CHAPTER 9
CALCULATION AND RESULTS

9.1 Calculation:

-Time Calculation = (R * C)

= (500 * 10^3 * 140 * 10^- 6)

= 70 sec

= 1 minute 10 sec

This is the timing given to Timer Circuit.

9.2 Results:

By varying the variable resistance we can adjust the timing in the range between 1 minute to 1 minute and 10 second.

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CHAPTER 10
ADVANTAGES

1. Reduce the switching cost.
2. Less time required for repeated switching.
3. Low switching maintenance.

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CHAPTER 11

APPLICATIONS

1. Small Scale Industries.
2. Protection Circuit for Household Equipment's.
3. ON / OFF switch for Motors.

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CHAPTER 12

CONCLUSION

From this circuit we can conclude that for repeated switching operation we can use this circuit instead of MCB or other switching devices. This may give us less maintenance of switching and also reduce the operation cost.

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CHAPTER 13

REFERANCES

1. Simple, Low Cost, and Efficient Design of a PC-based DC Motor Drive By Athraa Sabeeh Hasan.
2. www.google.com
3. www.wikipedia.org

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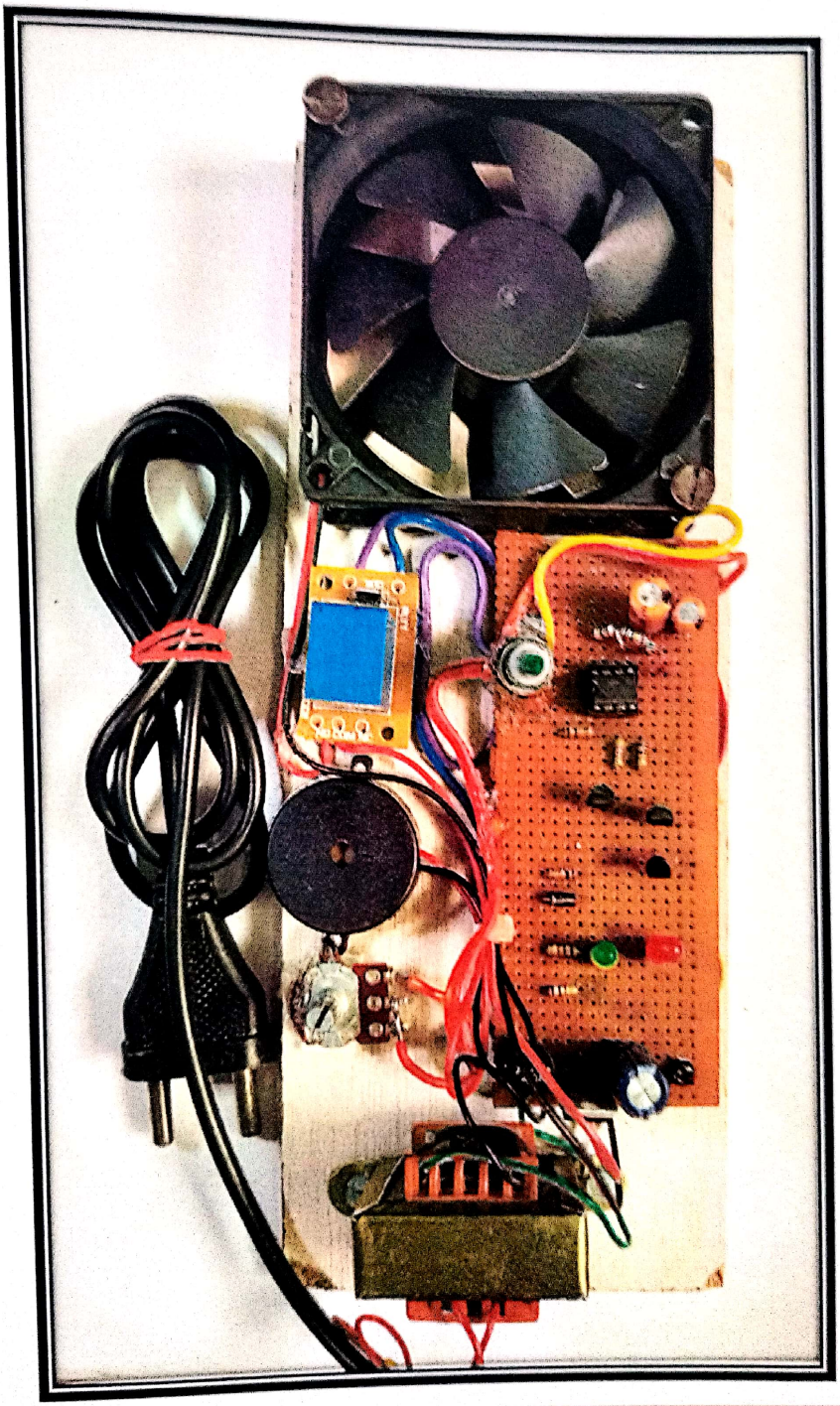
CHAPTER 14

PHOTOGRAPH



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